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AIR TECHNICAL INTELLIGENCE STUDY

NO. 102-AC-52/34-34

ANALYSIS OF THE SOVIET An-2 AIRCRAFT

PROJECT NO. 10156

15 AUGUST 1952

AIR TECHNICAL INTELLIGENCE CENTER
WRIGHT-PATTERSON AIR FORCE BASE
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DAYTON, OHIO

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SUMMARY

ANALYSIS OF THE SOVIET An-2 AIRCRAFT

I. Problem

To present an evaluation of the characteristics and performance capabilities of the Soviet An-2 light transport aircraft.

II. Factual Data

A. During the Aviation Day celebration in Moscow in July 1948 a group of seven (7) aircraft participating in the fly-by were reported as a new aircraft assigned to "Auxiliary Special Purpose Aviation" duties. One of these aircraft was a cabin bi-plane designed by O. K. Antonov, which has been identified as the An-2.

B. O. K. Antonov has previously been a designer of glider aircraft. The An-2 is the first powered aircraft that Antonov is known to have designed.

C. The An-2 began to appear in Poland in 1951 and there have been some reports that the An-2s based at Warsaw have an aerial camera hatch located in the bottom of the aircraft, just aft of the trailing edge of the lower wing.

D. The aircraft has been reported to be capable of taking off in a small distance and operating from extremely small and rugged airfields.

E. An-2s have also been seen towing as many as three (3) small gliders, and during an air show five (5) parachutists were observed to bail out of the aircraft.

F. Photographs of the An-2 have provided information as to the physical characteristics of the aircraft.

G. No confirmed air intelligence is available at this date regarding the performance and characteristics of the An-2 aircraft.

III. Digest

A. Available photographs of the An-2 indicate that external metal stiffeners are used on the upper surfaces of the wings. This would indicate that the wing is of all-metal construction. Photographs also show corrugated metal construction on the sides of the fuselage. It may be assumed from this photographic evidence that the aircraft is of all-metal construction with the possible exception of the control surfaces.

B. Control surfaces are apparently mounted along the entire trailing edges of both upper and lower wings. Flaps have been reported on the aircraft but the

amount of flap area is unknown. It is possible that the aircraft may have full span flaps on one wing and partial span flaps on the other wing, since it is reported that the An-2 can operate from very small airfields.

C. By comparison of the An-2 with other light cargo aircraft (see Table 1, Section I for comparison chart), it is estimated that the empty weight of the aircraft is about 8,000 lbs, and that the normal gross weight is about 12,200 lbs. Maximum gross weight is estimated to be 13,000 lbs, with a cargo capacity of 5,000 lbs. It is believed that the passenger capacity of the An-2 is limited by cabin space. The estimated size of the passenger (or cargo) cabin is approximately 170 inches from front to rear, and about 56 inches wide. Upon consideration of various seating arrangements, it appears that the cabin is capable of seating 14 people (see Fig. 5 for probable seating arrangement). Fourteen passengers would constitute a load of 2,800 lbs, resulting in an estimated take-off weight of 10,800 lbs.

D. In the roll of a photographic-reconnaissance aircraft, the weight of the An-2 is estimated to be 8,400 lbs. This weight was estimated on the basis that the airplane would carry a crew of three (3), and camera equipment weighing a total of about 200 lbs.

E. The engine for the An-2 was at first reported to be an ASh-21, rated 690 BHP at sea level. More recent intelligence information indicates that the ASh-62, rated 986 HP at sea level, is probably installed in the aircraft. ATIC considers this aircraft to be underpowered with the ASh-21 engine, whereas, with the ASh-62, the performance would be quite acceptable for a light transport. (See Table 1, Section I).

F. Reliable reports mention the location of a camera hatch in the floor of the An-2, just aft of the trailing edge of the lower wing. This may be one reason for the large outward slanting side windows at the pilot and co-pilot compartment, since good downward visibility would be required for a photographic mission. This aircraft is not unlike some commercial aircraft used in the U.S. for aerial photography and map making, an example of which is the Waco Model E cabin bi-plane, last built in 1941.

G. Available photographs of the aircraft show a conventional fixed antenna and also a pair of radio altimeter antennae.

IV. Conclusions

A. The An-2 is estimated to have a maximum speed of 138 knots at 5000 ft altitude, at a gross weight of 12,200 lbs, and at normal rated power.

B. The An-2 is estimated to have a sea level rate of climb of 770 fpm at a gross weight of 12,200 lbs, and at normal rated power.

C. The service ceiling of the An-2 at 12,200 lbs gross weight is estimated to be 15,000 ft.

D. Range and radius for the basic mission with an estimated 370 U.S. gals of fuel and 4,200 lbs cargo, corresponding to a take-off gross weight of 12,200 lbs, is as follows:

Range	853 NM
Radius	440 NM
Average cruise speed	96 knots

E. The An-2 as a reconnaissance aircraft is estimated to have a maximum speed of 144 knots at 5,000 ft, at a gross weight of 8,400 lbs, and at normal rated power.

F. The An-2, as a reconnaissance aircraft, is estimated to have a sea level rate of climb of 1610 fpm, at a gross weight of 8,400 lbs, and at normal rated power.

G. The service ceiling of the An-2 reconnaissance aircraft is estimated to be 24,000 ft.

H. Range and radius for the photo-reconnaissance mission at 10,000 ft, with an estimated 370 U.S. gals of fuel and 400 lbs of cargo, corresponding to a take-off gross weight of 8,400 lbs, is as follows:

Range	988 NM
Radius	489 NM
Average cruise speed	125 knots

I. At take-off gross weight of 8,400 lbs, take-off distance to clear 50 ft obstacle is estimated to be 770 ft. (For take-off distance values corresponding to alternate weight conditions, see Take-off Distance Chart, Fig. 4).

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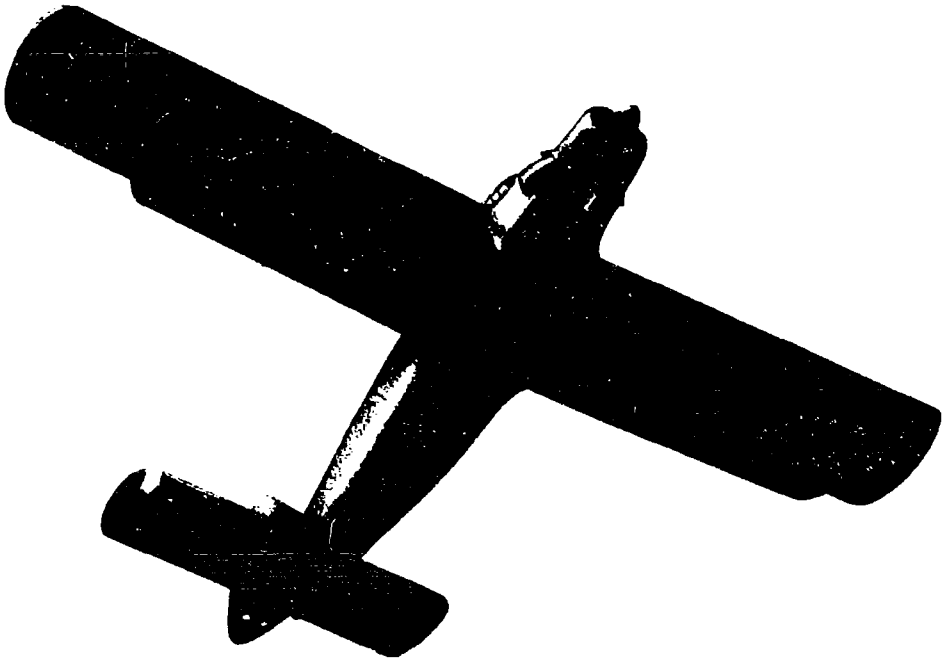

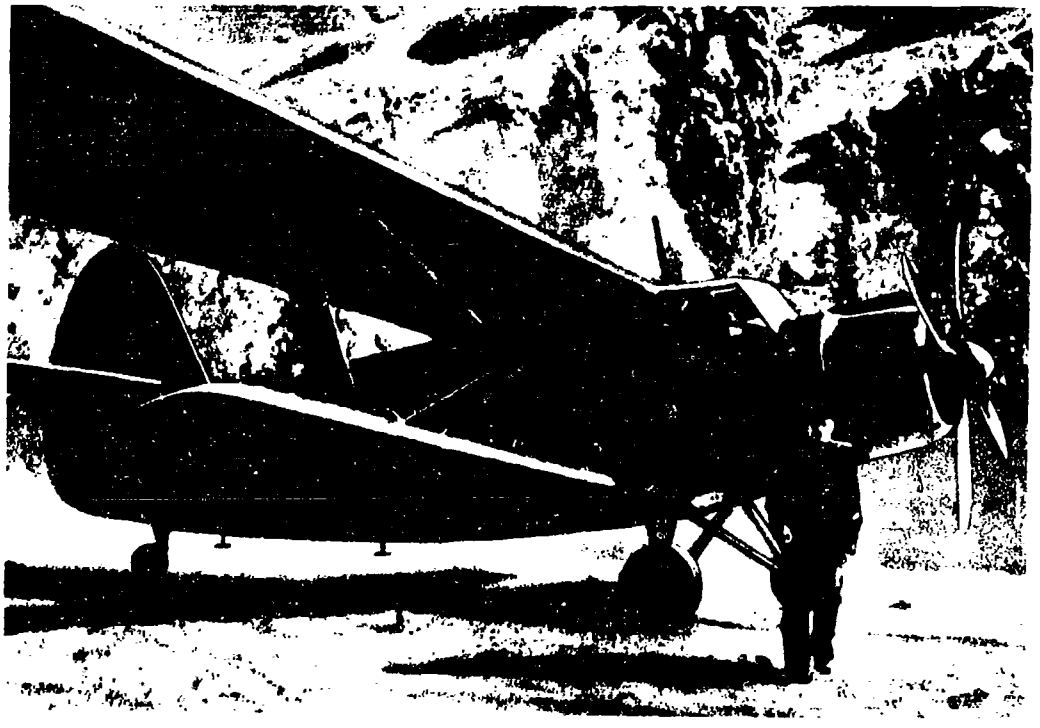

Fig. 1 Photographs of An-2 Aircraft

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SECTION I

CHARACTERISTICS AND PERFORMANCE OF THE AN-2 LIGHT TRANSPORT AIRCRAFT

A. Physical Characteristics

The An-2 is a single engine cabin bi-plane. The fuselage of the aircraft is rectangular in cross section.

The power plant of the airplane is neatly cowled and a large spinner is installed on a four-bladed scimitar type propeller. Entry to the fuselage is made through a door at the rear of the cabin on the port (left) side of the aircraft.

The cockpit canopy is built out on the sides giving excellent downward visibility.

The upper and lower semi-spans of the wings are joined by a single interplane strut and are braced by external flying and landing wires, typical to bi-plane designs.

The horizontal stabilizer is braced underneath by an external strut. The vertical tail is rounded and quite large.

The landing gear is fixed and the wheels appear to be of the low pressure type.

The estimated dimensions of the An-2 are as follows:

Upper wing span	48 ft 8 in
Upper wing area	340 sq ft
Lower wing span	37 ft 4 in
Lower wing area	210 sq ft
Total wing area	550
Fuselage length	37 ft 2 in

The estimated gross weights of the An-2 are as follows:

Loading Condition	Gross Weight (lbs)
1. Empty	5,580
2. 14 passengers	10,800
3. 8 passengers and 2,600 lbs cargo	12,200
4. 5,000 lbs cargo	13,000
5. Crew of 3 and 200 lbs camera equipment	8,400

The fuel capacity is estimated to be 370 U.S. gals.

B. Performance

The performance of the An-2 has been calculated for four (4) weight conditions: (1) with 14 passengers, gross weight 10,800 lbs; (2) with 8 passengers and 2,600 lbs cargo, normal gross weight 12,200 lbs; (3) 5,000 lbs cargo, maximum gross weight 13,000 lbs; and (4) with a crew of three (3) and 200 lbs of camera equipment, gross weight 8,400 lbs.

The increase in induced drag due to the bi-plane configuration was taken into account.

The performance is summarized in figure 2; take-off distance over a 50 foot obstacle is shown for various weights in figure 5.

The combat range and radius of the An-2 has been estimated on the basis of standard USAF Specifications (MIL-C-5011A, Nov 1951).

C. Aerodynamic Analysis

The An-2 appears to have been designed as a utility cargo aircraft. The bi-wing configuration provides the low wing loading (22.2 lbs/sq ft) needed for short take-off distance and high load carrying ability. The apparent employment of full span flaps, further increases the airplane's capacity to land and take off from small airfields.

The low wing loading derived from the bi-wing configuration also gives the An-2 a higher service ceiling capability than is found with most light transport airplanes.

The profile drag coefficient for the airplane was estimated to be 0.043. This profile drag coefficient was based on an estimated wetted area for the aircraft of 1986 sq ft and an estimated cleanliness factor of 0.0120.

TABLE I

LIGHT TRANSPORT COMPARISON CHART

Aircraft	H.P. T.O.	Gross Weight (lbs)	Payload (lbs)	Fuel (lbs)	Wing Loading (lbs/ft)	Ratio of Payload plus fuel to Gross Weight	Range (NM)
An-2	986	12,200	4,200	2,220	22.2	.525	850
Bellanca Aircruiser	760	11,400	4,021	1,800	17.4	.511	1100
Noorduyn Norseman	550	7,400	3,150	720	22.8	.520	600
Waco Model E	300	4,200	1,439	750	14.7	.521	--
Fairchild "82"	550	6,325	1,762	800	--	.405	657
Fairey Albacore	1035	10,792	4,145	1,740	--	.545	640
Bellanca Skyrocket	550	6,450	2,690	800	15.5	.540	1000

TABLE II

AN-2 PERFORMANCE SUMMARY

	Normal Gross	With 14 Passengers	Maximum Gross	Camera Mission
Weight (lbs)	12,200	10,800	13,000	8,400
Vmax at sea level (knots)	132	134	130	138
Vmax at altitude (knots)	138	141	136	144
Sea level rate of climb (fpm)	770	1,050	650	1,610
Service ceiling (ft)	15,000	19,[illegible]	13,000	24,000
T.O. distance over 50 ft obstacle (ft)	1,470	1,220	1,620	770

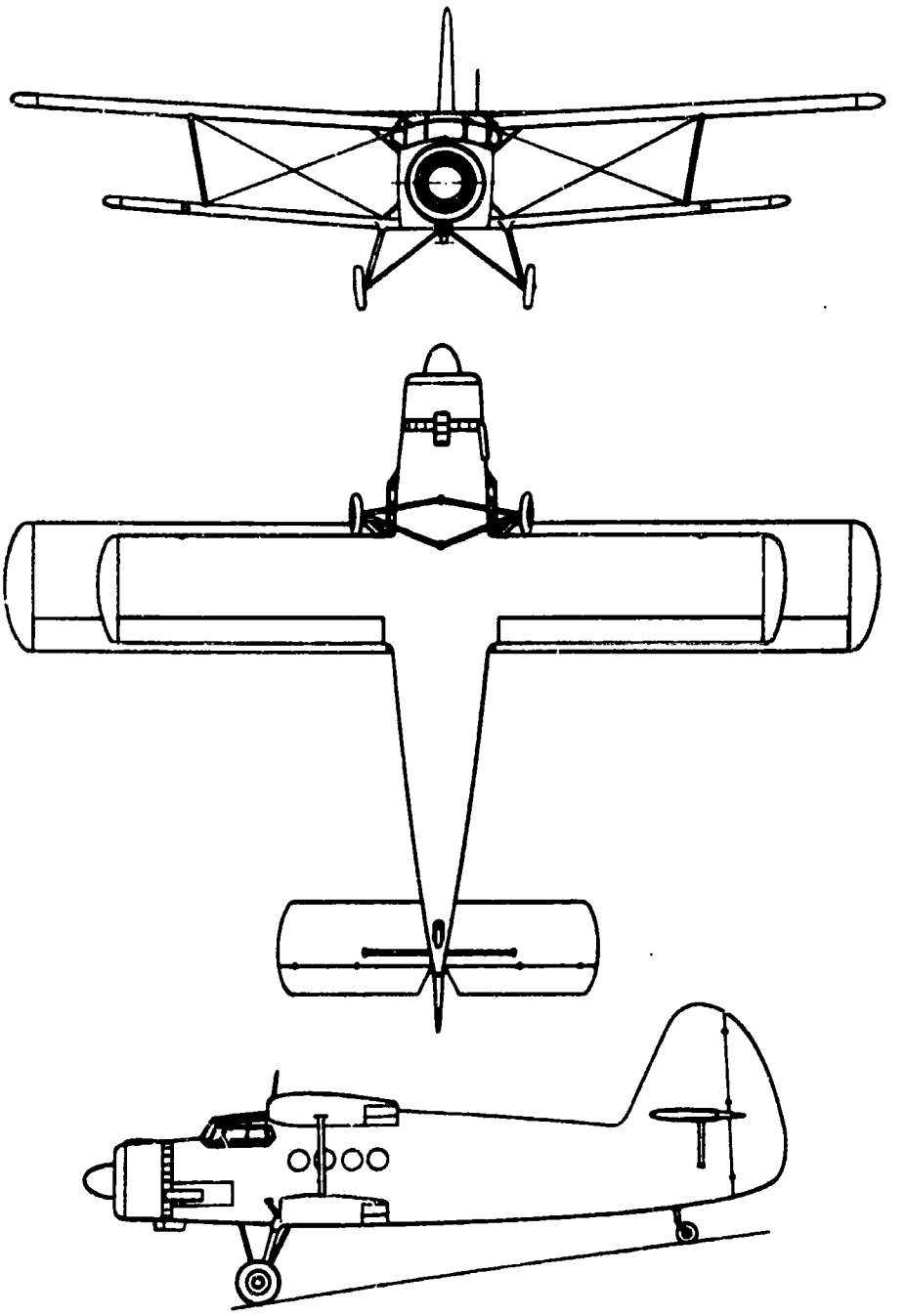

Fig. 2 Three-View of An-2 Aircraft

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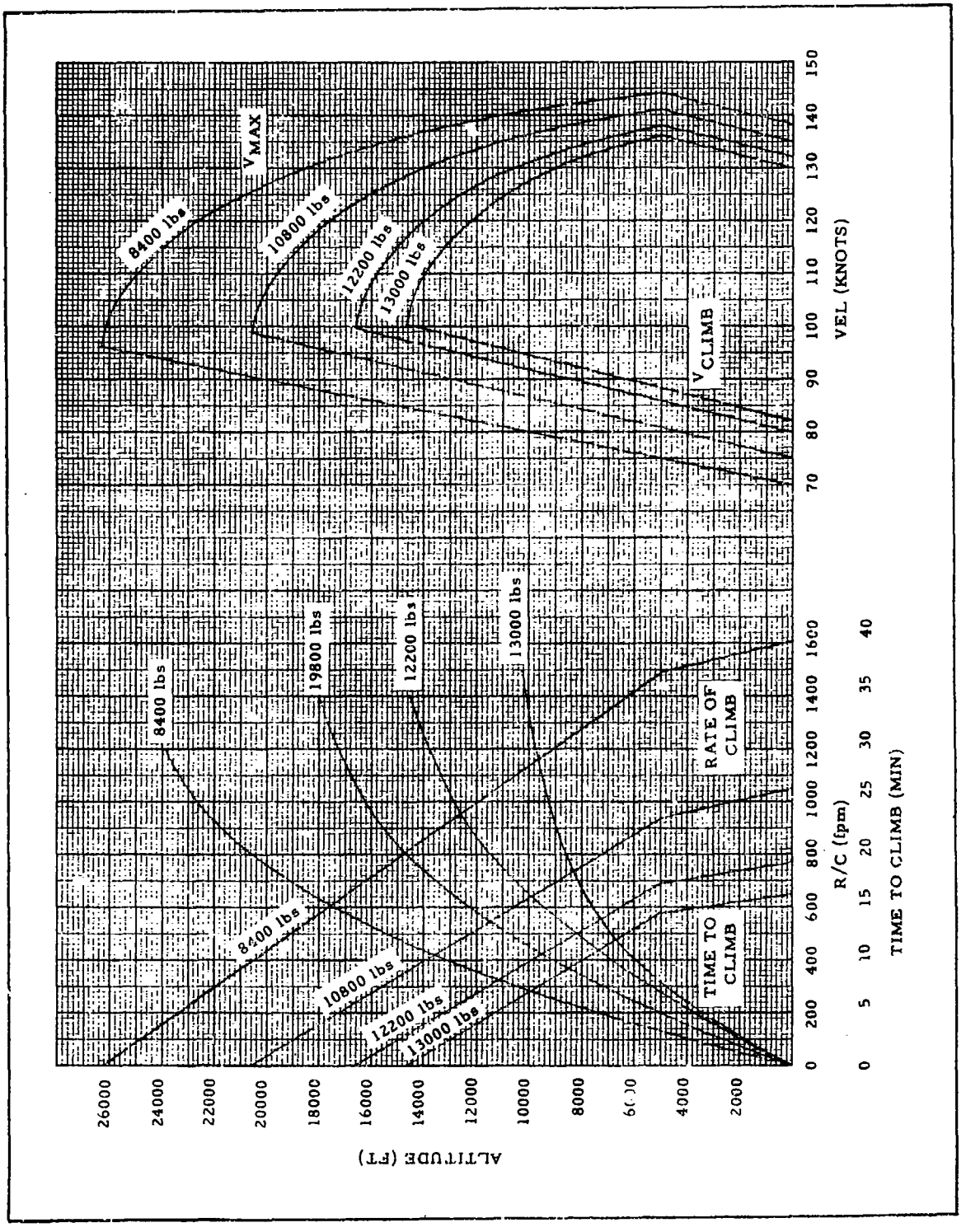

Fig. 3 Estimated An-2 Aircraft Performance - ASh-62 Engine

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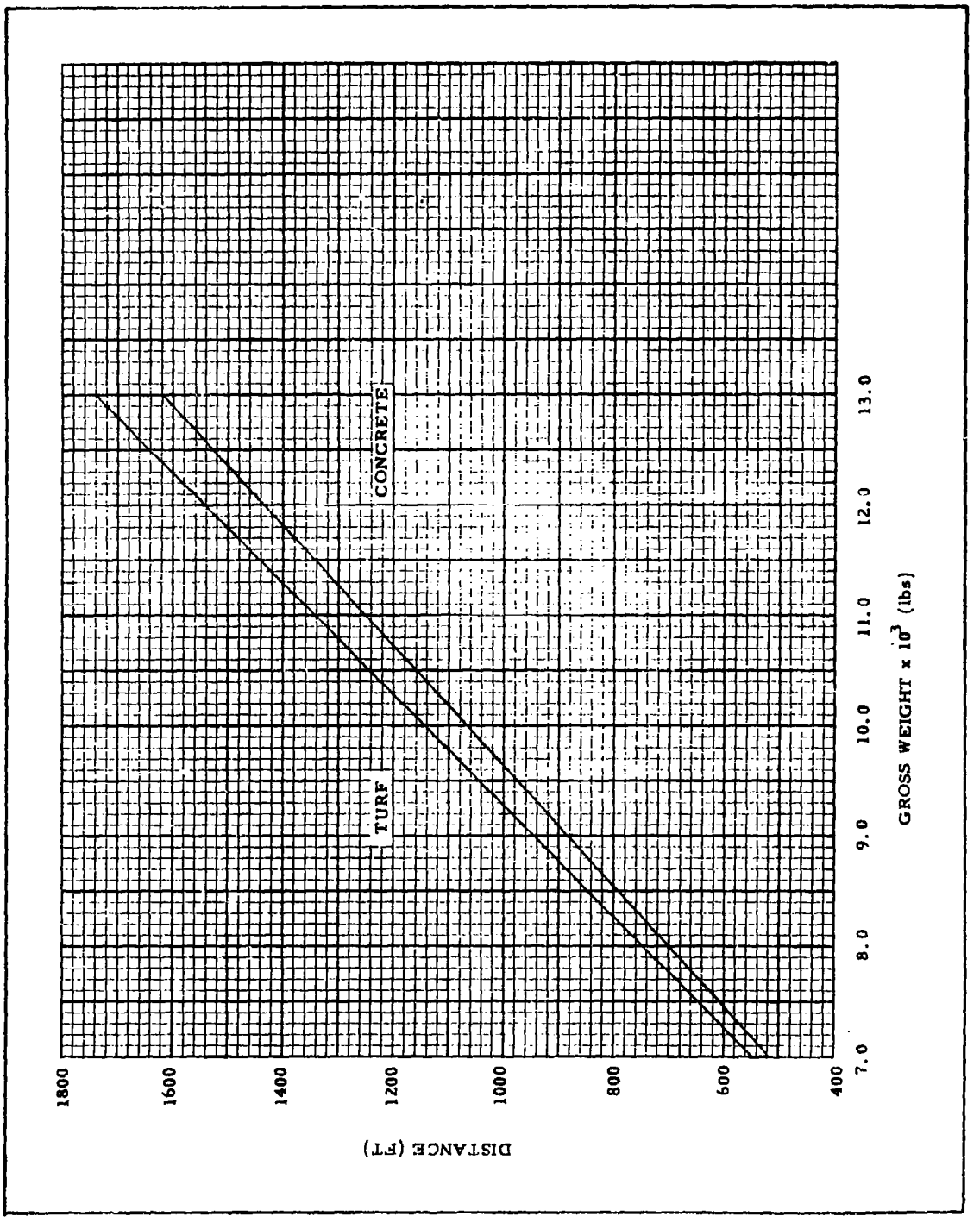

Fig. 4 Estimated An-2 Take-off Distance Over 50 ft Obstacle - ASh-62 Engine

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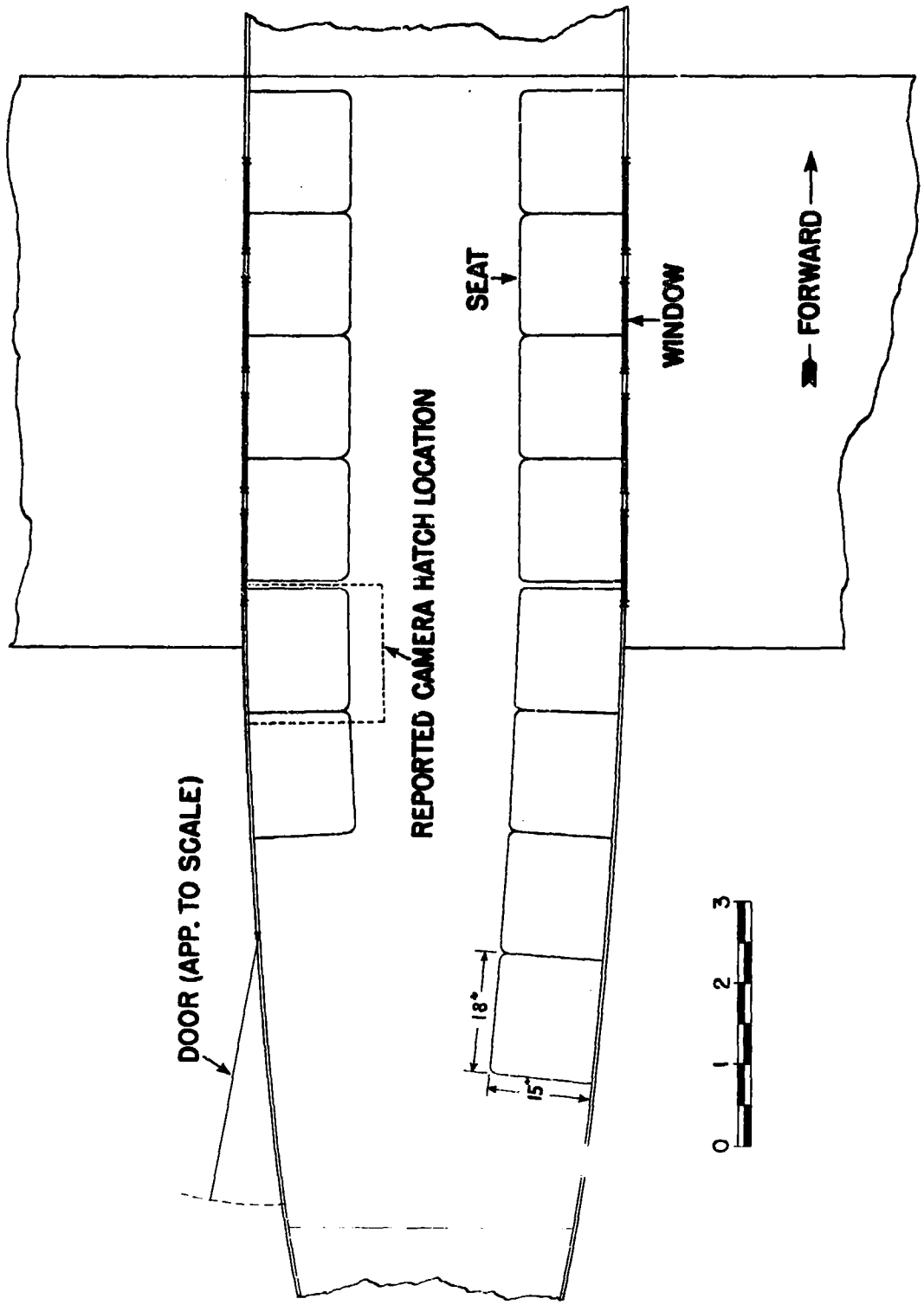

Fig. 5 An-2 Seating Arrangement

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SECTION II

POWER PLANT

Engine Installation

It is now believed that the ASh-62 engine powers the An-2 aircraft. This engine is manufactured by the USSR under rights originally purchased in 1932 through a license agreement with Wright Aeronautical Corporation, U.S.A. It is a faithful reproduction of the W.A.C. C9 Cyclone (R-1820) engine. The ASh-62 IR is a 9 cylinder radial, air-cooled, reciprocating aircraft engine of the 950-1000 HP class. It has a 4-barrel, downdraft, pressure type carburetor AKM-62 IR with automatic mixture control. The engine incorporates a single stage, single speed supercharger, dual ignition system and electric starter. Two BSM-9 magnetos, 18 spark plugs of the AC 130 type are used and the engine operates on 90 octane fuel. Following are physical data of the engine:

Bore	6.12 in
Stroke	6.86 in
Displacement	1820 cu in
Diameter	54.15 in
Weight	1189 lbs
Compression Ratio	6.4:1
Supercharger Gear Ratio	7:1
Reduction Gear Ratio	11:16

SECTION III

ELECTRONICS EQUIPMENT

The only knowledge of electronic equipment installed in this aircraft is that indicated by the protruding antennas visible in two photographs. The vertical mast extending above the forward part of the fuselage is probably a support for a long wire antenna. Although the antenna wire itself is not visible in the photograph, the Soviet communications and navigation equipment available for military installations is in the standard high frequency band requiring an external long wire antenna to obtain reasonable operating ranges.

The communications equipment most likely to be installed is the RSB-bis transmitter-receiver set which covers a frequency range of 175 Kc/s - 12 Mc/s. This set is usually installed in Soviet multi-seat aircraft because its wide frequency range is desirable for long range and varied types of operations. Other equipments available include the RSI-4 and RSI-6 communication sets. The RSI-4 is a World War II vintage set covering a frequency range of 3.75 - 5 Mc/s. This set resembles American equivalents in construction during the period of 1935 - 1937 and has since been replaced in most Soviet aircraft by the later and improved RSI-6. Although both the RSI-4 and RSI-6 cover the same frequency range, the RSI-6 sets have incorporated more modern components and construction techniques, and provide an excellent single channel lightweight reliable communications set. All the above mentioned sets have been more completely described in ATIC Study No. 102-EL-51/19-34.

A pair of radio altimeter antennas are mounted on the under side of the fuselage. At least two types of radio altimeters are available for installation with this type antenna; the high altitude pulse type altimeter and the low altitude FM altimeter. The low altitude FM type altimeter is described in ATIC Study No. 102-EL-51/17-34.

In addition to the electronics equipment indicated by the visible antennas, this aircraft probably also carries a homing receiver or radio compass receiver for navigation purposes. Postwar equipment available includes either American Lend-Lease radio compass sets or the Soviet built RPKO-10M homing receiver. The RPKO-10M set covers a frequency range of 270 - 740 Kc/s and originally used an externally mounted, air-core, fixed loop antenna. A more recent antenna available for use with this receiver is a flat, iron-core, flush-mounting fixed loop antenna. The RPKO-10M set is also described in ATIC Study No. 102-EL-51/17-34.

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DEPARTMENT OF THE AIR FORCE
WASHINGTON, DC

23 June 2010

HAF/IMIO (MDR)
1000 Air Force Pentagon
Washington, DC 20330-1000

Bobby Sammons.
P.O. Box 1680
Cloudcroft, NM 88317-1680

Dear Mr. Sammons

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The review for the documents have been completed and the declassification has been downgraded to UNCLASSIFIED and copies are attached for your information.

Address any questions concerning this review to the undersigned at (703) 692-9979 and refer to our case number 07-MDR-076.

Sincerely

JOANNE MCLEAN
Mandatory Declassification Review Specialist

2 Attachments
1. Letter, Request for Documents
2. 10 DTIC Documents

cc: DTIC w/o documents